

ASTROMETRIC OBSERVATIONS OF COMETS AND ASTEROIDS  
AND SUBSEQUENT ORBITAL INVESTIGATIONS

Grant NGR 09-015-212

Semiannual Progress Report No. 27

For the period 1 November 1986 through 30 April 1987

Principal Investigators

Dr. Richard E. McCrosky

Dr. Brian G. Marsden

May 1987

prepared for

National Aeronautics and Space Administration

Washington, D.C.

Smithsonian Institution  
Astrophysical Observatory  
Cambridge, Massachusetts 02138

The Smithsonian Astrophysical Observatory  
is a member of the  
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1. Personnel

Observations, data reduction and interpretation of results contributing to this research are performed by Principal Investigator R. E. McCrosky and Co-Investigator B. G. Marsden; and by G. Schwartz, C.-Y. Shao, C. M. Bardwell and D. W. E. Green as members of their research groups. The services of all except Shao and less than 10 percent of Bardwell are provided at no cost to NASA.

2. Observing Program

The 155-cm reflector was used for observations of comets and minor planets on 35 nights during October-April. To the record 100 observations reported here for October can be added the six already mentioned in the previous report. The distribution was fairly uniform during November-February, but poor weather permitted only 21 observations during March. Table 1 lists the 423 measurements published (in the MPCs) since the last report, two of them actually made at the very beginning of May 1987. Seventeen of the measurements refer to plates exposed earlier in 1986 and in 1985, and two were republished as redesignations of observations originally made in 1977. Forty-six of the observations refer to comets, 193 to numbered minor planets (numbered, that is, by the end of the

semester: only 11 of them refer to minor planets already numbered at the time of the last report), and the remainder to unnumbered minor planets.

The observing and measuring has generally been done by McCrosky, Schwartz and Shao. Most of the checking of the results and the selection of objects to be observed was done by Bardwell. The reductions were mainly done on the NOVA computer at the Oak Ridge Observatory, while the remaining computations were done on a MicroVAX computer in Cambridge.

### 3. Results of Special Interest

Observations were made of seven new comets discovered during the semester, and there was continuing coverage during the autumn of comet 19861 (a rather bright southern object in April) and in the spring of P/Halley.

The new earth-approaching objects 1986 RA and 1986 WA were observed, and there were continuing observations of 1986 LA.

The following minor planets were numbered entirely as the result of our observations: (3516) 1982 UH7, (3521) 1982 MH, (3522) 1941 SW, (3524) 1981 EE27, (3529) 1981 EQ19, (3530) 1981 EC20, (3531) 1981 FB, (3536) 1981 EV20, (3538) 6548 P-L, (3543) 1964 VA3, (3547) 1978 TM6, (3557) 1977 QE1, (3558) 1978 SQ2, (3561) 1983 HO, (3575) 1984 DU2, (3576) 1984 DB3, (3577) 1969 TK, (3580) 1983 CS2, (3586) 1978 SW6, (3588) 1981 TH4, (3589) 1984 AB1, (3590) 1984 CQ, (3593) 1981 EB20, (3599) 1978 PB3, (3604) 5550 P-L, (3605) 1932 WB, (3608) 1978 SD1, (3610) 1981 EA1, (3613) 1982 VJ11, (3614) 1983 AE1, (3616) 1984 JJ2, (3617) 1984 LJ, (3618) 1979 QP8, (3622) 1981 SX7, (3624) 1982 TH2, (3626) 1929 PA and (3627) 1973 DS.

#### 4. Orbital Investigations

Computations of preliminary and improved orbits continued in routine fashion. Among the many minor-planet identifications we found was (473) Nollis, which had been lost since 1901. Together with identifications by other investigators, this reduced the number of lost numbered minor planets to three, or to rather better than the 0.1-percent level.

#### 5. Publications

Observations from Oak Ridge plates are included in the following publications issued during this half year: Minor Planet Circ. Nos. 11277-11278, 11329-11330, 11379-11380, 11414-11415, 11468, 11496-11497, 11564-11567, 11604-11605, 11683-11686, 11714-11716, 11779 and 11822-11823; IAU Circ. Nos. 4279-4280, 4302 and 4307. Orbital computations are on Minor Planet Circ. Nos. 11331-11332, 11336, 11339-11345, 11416-11417, 11428-11437, 11500-11506, 11516-11519, 11611-11620, 11622-11623, 11625-11631, 11721-11722, 11729-11730, 11733-11745, 11825-11826 and 11831-11848; IAU Circ. Nos. 4268-4271, 4279-4280, 4290-4291, 4294-4296, 4302, 4305, 4307, 4310-4311, 4313, 4335, 4344-4345, 4360, 4363-4364, 4380-4381 and 4384.

## Table 1

### Positional measurements

The successive columns give the object's designation (/ = comet, \* = new discovery), the UT date and time, the right ascension (in hours, minutes and seconds) and declination (in degrees, minutes and seconds) -- equinox 1950.0.

/1985 XII	1986 10	07.40259	05 46	40.75	-16 56	14.0
/1985 XII	1986 10	30.39608	05 26	40.76	-18 00	53.7
/1985 XII	1986 10	31.39966	05 25	37.06	-18 02	36.0
/1985 XII	1986 11	30.27219	04 49	55.13	-17 44	38.4
/1985 XII	1986 12	28.15360	04 18	07.51	-15 18	38.4
/1985 XII	1987 01	28.02600	03 55	49.43	-11 09	38.2
/1985 XII	1987 02	24.02377	03 48	51.36	-07 22	27.4
/1985 XII	1987 02	28.00334	03 48	39.61	-06 50	38.1
/1982i	1986 11	28.42423	11 40	05.32	-14 44	18.9
/1982i	1986 12	28.41353	11 31	24.19	-16 13	08.0
/1982i	1987 01	29.36030	11 06	00.53	-16 02	31.7
/1982i	1987 02	27.25387	10 34	05.30	-13 47	59.9
/1982i	1987 04	02.12771	10 02	02.64	-09 44	02.7
/1986l	1986 09	30.98030	20 30	36.06	+10 28	01.7
/1986l	1986 10	02.00026	20 28	59.79	+10 05	16.7
/1986l	1986 10	07.02667	20 21	34.78	+08 13	41.7
/1986l	1986 10	29.05060	19 58	58.64	+00 45	36.5
/1986l	1986 10	29.95104	19 58	22.75	+00 29	14.4
/1986l	1986 10	30.94876	19 57	44.53	+00 11	17.9
/1986l	1986 10	31.95205	19 57	07.89	-00 06	30.6
/1986l	1986 11	28.94575	19 50	02.09	-07 02	17.6
/1986l	1986 11	30.94832	19 50	08.39	-07 26	42.1
/1986n	1986 11	28.19644	03 08	51.14	+28 01	04.0
/1986n	1986 12	27.99192	00 38	25.44	+17 23	25.2
/1986n	1986 12	29.00966	00 35	35.00	+17 04	27.8
/1986n	1987 01	03.94933	00 21	17.42	+15 25	15.5
/1986n	1987 01	28.00092	23 49	56.00	+11 28	16.1
/1986n	1987 01	28.98896	23 49	13.79	+11 22	48.1
/1986n	1987 01	29.98626	23 48	32.83	+11 17	33.1
/1986o	1986 12	01.09876	01 14	20.89	+38 52	30.7
/1986o	1986 12	02.07049	01 13	50.30	+39 17	59.0
/1986o	1986 12	28.23228	01 27	59.90	+47 41	15.4
/1986o	1987 01	27.13919	02 39	07.56	+52 43	43.2
/1986o	1987 01	29.15786	02 45	25.80	+52 55	23.9
/1986p	1986 12	02.16564	01 49	05.48	+13 49	49.0
/1986p	1986 12	05.01847	01 51	10.07	+13 53	55.3
/1987a	1987 01	29.43586	16 53	47.88	+02 43	43.8
/1987a	1987 02	24.42234	15 59	01.81	-08 03	04.3
/1987b	1987 01	27.20247	07 38	12.50	-02 07	36.6
/1987c	1987 01	21.99584	00 00	29.51	+05 53	24.7
/1987c	1987 01	27.99138	23 51	57.81	+03 52	12.6
/1987c	1987 01	28.98180	23 50	43.51	+03 34	08.4
/1987c	1987 01	29.97799	23 49	31.44	+03 16	25.8
/1987d	1987 02	24.99651	01 54	41.94	-11 57	44.5
/1987d	1987 02	25.98761	01 57	52.73	-11 28	57.8
/1987d	1987 02	26.99665	02 01	02.84	-11 00	18.4
75	1987 02	26.30655	11 15	17.59	+06 46	24.1
342	1986 11	29.97181	21 34	08.12	-07 26	04.2
342	1986 11	30.96165	21 35	15.84	-07 23	01.4
487	1987 01	27.09819	04 53	09.54	+16 55	30.8
581	1987 01	30.19866	07 00	45.05	+27 45	04.4
1070	1987 03	29.18465	10 44	44.17	+08 48	11.2
1201	1987 03	27.31716	12 58	34.18	-08 19	09.0
2197	1986 10	08.13947	23 17	15.30	-07 56	09.4
2411	1987 01	30.26189	08 00	50.70	+20 09	59.8
3103	1987 02	27.33827	09 39	33.36	+34 14	01.9
3498	1986 10	07.13853	22 42	00.77	+00 15	49.8
3508	1986 10	06.17463	22 45	05.72	-10 29	28.1

3509	1986	10	06.15421	22	54	08.27	+08	52	57.7
3510	1986	09	08.38303	02	05	32.19	+21	22	38.7
3510	1986	10	06.30208	01	50	30.40	+20	53	54.6
3511	1986	09	01.22773	22	52	16.39	+05	44	23.2
3511	1986	10	08.11186	22	26	53.06	+01	44	35.1
3512	1986	10	06.28177	01	11	38.41	-10	27	35.5
3512	1986	10	08.25850	01	10	04.55	-10	42	05.0
3513	1986	10	06.06444	22	32	06.65	-07	19	13.8
3514	1986	09	01.26877	23	17	17.54	-08	10	35.7
3514	1986	10	06.12403	22	56	04.89	-09	44	47.7
3515	1986	08	06.24480	22	31	18.91	-09	50	33.8
3515	1986	10	03.12243	21	52	23.61	-12	59	02.0
3516	1986	09	08.18518	21	05	13.89	-15	38	42.0
3516	1986	10	08.04748	21	01	02.81	-16	27	10.9
3517	1986	11	01.02975	22	23	45.96	-09	27	44.2
3518	1986	10	29.09118	23	51	19.56	-16	15	25.3
3518	1986	11	01.15311	23	50	59.18	-16	16	14.1
3520	1986	10	31.15860	00	47	52.44	-04	16	45.2
3521	1986	10	08.21168	00	20	27.78	-03	36	30.6
3521	1986	11	01.17470	00	02	37.04	-04	26	17.9
3523	1986	10	07.29848	01	51	50.98	+02	27	33.7
3523	1986	10	30.16873	01	28	53.21	+01	25	47.5
3525	1985	08	18.09085	20	38	39.30	-16	28	32.2
3525	1986	10	08.30045	01	37	26.32	+14	02	45.9
3525	1986	10	29.16762	01	21	24.39	+12	26	16.0
3526	1985	05	24.19284	15	37	34.89	-23	40	35.1
3526	1986	09	08.33996	00	31	25.10	-06	53	52.6
3526	1986	10	07.17493	00	06	51.23	-08	19	48.7
3526	1986	11	30.98413	23	51	39.84	-05	54	54.2
3527	1986	10	07.21079	00	31	16.13	+07	55	13.2
3527	1986	10	31.14180	00	13	16.43	+04	54	10.6
3528	1986	10	30.96644	21	07	10.16	-07	43	03.2
3530	1986	10	07.25747	01	20	43.52	+10	51	07.7
3530	1986	10	29.14920	01	02	41.57	+08	45	34.4
3532	1986	10	07.28120	01	39	38.28	-00	01	01.8
3532	1986	10	30.15537	01	19	48.68	-00	36	54.7
3534	1986	10	08.32406	01	56	51.78	+20	45	32.3
3534	1986	10	29.18633	01	40	10.27	+18	25	06.2
3535	1986	11	30.08566	01	57	49.68	+13	45	29.5
3536	1986	10	08.18918	23	34	59.71	+01	56	02.1
3536	1986	11	01.09305	23	21	52.22	+01	09	43.8
3537	1986	10	08.34527	02	13	05.43	+04	19	22.3
3537	1986	10	29.20626	01	50	11.74	+04	50	20.5
3537	1986	12	05.11624	01	23	50.80	+07	15	30.1
3538	1986	10	08.39182	03	21	17.56	+13	05	25.9
3538	1986	10	31.25805	03	11	37.98	+11	00	36.9
3538	1986	11	30.20469	02	49	15.30	+08	39	25.5
3540	1986	11	28.21215	03	32	35.78	+37	02	01.1
3543	1986	09	01.34684	00	37	30.44	+03	32	55.9
3543	1986	10	03.28709	00	16	14.38	+01	05	14.6
3545	1986	10	07.34005	02	12	21.86	+10	38	41.0
3545	1986	10	29.22472	01	54	27.33	+09	19	51.2
3547	1986	10	31.23980	02	55	25.71	+22	09	29.5
3547	1986	12	05.17118	02	25	45.49	+18	50	34.9
3548	1986	10	29.39874	04	08	02.64	+23	43	08.0
3548	1986	10	31.37376	04	07	05.03	+23	43	19.5
3553	1986	11	30.25487	04	15	14.66	-05	55	40.9
3554	1986	12	28.43614	13	49	15.56	+19	18	26.1



3554	1987	01	29.41372	14	18	28.22	+11	13	54.0
3554	1987	02	24.40705	14	04	49.24	+02	49	36.4
3554	1987	03	29.21983	11	35	48.02	-16	41	50.5
3556	1986	10	03.26798	23	06	29.58	+08	59	32.4
3557	1986	10	30.37009	04	01	00.53	+14	34	32.1
3557	1986	10	31.32802	04	00	28.74	+14	31	41.0
3557	1986	11	28.25334	03	42	34.33	+13	12	48.4
3558	1986	11	28.16216	01	44	02.68	+30	32	21.6
3558	1987	01	03.98901	01	43	26.31	+27	55	37.1
3561	1986	10	03.31109	03	11	45.08	+05	21	52.7
3561	1986	10	07.36566	03	10	10.66	+05	08	25.4
3561	1986	10	29.28445	02	58	17.48	+03	57	42.3
3562	1986	10	31.19593	01	42	12.35	+01	36	46.4
3563	1986	11	29.97181	21	33	44.36	-07	31	11.6
3564	1986	10	29.26077	03	15	30.98	+27	04	37.2
3564	1986	10	29.30735	03	15	29.37	+27	04	36.1
3564	1986	11	28.18172	02	58	02.70	+26	38	44.3
3568	1986	11	30.10337	01	30	33.69	-01	46	04.4
3568	1986	12	29.03344	01	31	44.96	+03	04	42.2
3569	1986	10	08.28170	01	12	08.98	-05	50	09.3
3569	1986	12	05.04162	00	46	39.77	-09	27	28.6
3571	1986	12	28.09674	03	07	34.88	+19	11	47.3
3571	1986	12	29.13988	03	07	19.16	+19	09	19.1
3571	1987	01	28.05038	03	07	24.44	+18	31	03.8
3574	1986	12	01.35814	05	32	44.79	+18	51	56.0
3574	1986	12	28.20876	05	05	00.88	+17	34	38.3
3575	1986	12	01.18042	01	46	44.02	+05	02	07.4
3575	1987	01	04.01293	01	44	19.30	+06	34	05.4
3576	1986	12	01.19932	02	52	40.54	+28	35	29.5
3576	1987	01	04.06287	02	41	30.06	+28	05	28.1
3577	1986	11	28.36808	06	12	23.43	+24	48	37.7
3577	1987	01	04.31640	05	45	12.46	+24	12	28.5
3578	1987	01	04.33174	06	01	31.90	+29	04	18.7
3580	1986	11	01.26621	03	14	09.25	+22	29	28.0
3580	1986	12	28.04986	02	33	47.83	+19	31	33.0
3581	1986	10	29.41585	06	14	29.85	-00	46	49.5
3581	1986	10	30.41732	06	14	15.64	-00	59	34.5
3583	1987	01	03.96273	01	43	42.27	+12	20	49.9
3586	1986	10	31.21858	02	40	03.73	+25	16	37.4
3586	1986	12	02.18253	02	08	54.75	+23	43	05.4
3587	1986	12	01.29763	04	18	16.70	+28	48	15.6
3587	1986	12	28.25081	03	53	52.03	+28	20	36.2
3588	1986	09	08.21768	22	18	55.08	-09	19	23.5
3588	1986	10	30.02708	22	00	15.29	-09	53	26.8
3589	1985	05	24.23112	15	55	24.24	-14	35	38.3
3589	1986	10	07.38434	03	49	49.07	+12	02	19.4
3589	1986	10	29.32714	03	41	45.20	+11	05	45.3
3589	1986	11	01.29692	03	39	23.29	+10	57	44.0
3590	1987	01	27.09819	04	53	36.38	+16	54	26.5
3590	1987	02	25.04437	05	09	04.90	+19	37	27.0
3591	1987	02	27.21448	09	32	17.40	+16	05	16.2
3592	1987	01	28.38054	10	00	55.05	+30	02	23.2
3592	1987	02	24.19159	09	29	47.10	+30	29	11.4
3593	1986	12	01.40797	07	48	50.18	+21	05	06.9
3593	1987	01	28.24730	07	00	44.69	+21	53	45.8
3594	1987	01	27.34380	09	40	32.71	+25	38	46.1
3594	1987	01	28.36094	09	39	24.75	+25	39	20.9
3594	1987	02	24.17765	09	08	12.44	+25	02	38.1

3595	1986	11	30.38868	09	27	36.36	+11	44	32.8
3595	1987	01	29.33315	09	04	34.24	+12	23	54.6
3595	1987	02	26.21559	08	40	54.40	+14	08	28.0
3596	1986	12	29.21969	02	11	26.36	+38	21	25.5
3596	1987	02	26.00501	02	33	59.67	+36	49	13.7
3597	1986	12	29.26235	05	37	25.26	+23	30	51.1
3598	1987	01	28.26268	08	23	47.39	+18	40	01.4
3598	1987	02	27.14165	08	02	56.40	+19	53	14.2
3598	1987	02	28.13458	08	02	29.80	+19	54	48.5
3599	1987	01	28.30271	09	05	12.50	+15	22	03.4
3599	1987	02	25.22770	08	43	36.76	+17	04	16.7
3600	1986	10	08.16101	23	35	27.70	-03	46	05.9
3600	1986	11	01.12940	23	21	47.65	-04	10	43.3
3601	1987	01	29.31583	08	57	54.76	+20	28	07.1
3601	1987	02	24.13445	08	38	11.97	+21	41	58.6
3602	1986	11	01.24577	01	02	33.76	+12	39	33.8
3602	1986	12	02.04412	00	51	43.06	+09	21	05.9
3604	1985	09	17.26068	23	42	54.64	-11	04	31.8
3604	1986	11	28.30963	05	55	10.46	+39	43	25.5
3604	1987	02	27.04376	05	07	21.07	+37	10	11.7
3605	1986	12	01.24706	03	11	21.68	+22	50	04.4
3605	1986	12	29.12500	02	57	03.49	+20	27	22.2
3605	1987	01	29.11698	03	12	38.04	+20	00	40.1
3605	1987	02	02.08633	03	16	39.03	+20	06	24.4
3606	1986	12	05.42321	08	22	45.86	+08	35	18.1
3606	1986	12	28.34493	08	09	20.63	+07	04	50.1
3607	1987	02	26.24293	08	49	31.63	+21	09	03.3
3608	1986	12	28.38473	08	36	41.27	+28	01	32.7
3608	1987	01	27.24205	08	14	22.24	+30	12	56.2
3608	1987	02	24.11056	07	55	05.69	+31	07	50.8
3609	1987	01	30.24321	07	26	55.02	+28	15	56.0
3609	1987	02	24.09008	07	16	47.85	+28	24	17.7
3609	1987	02	28.06522	07	16	55.64	+28	19	57.9
3610	1987	01	30.13542	06	18	08.25	+23	01	52.4
3610	1987	02	25.10655	06	16	27.34	+23	33	46.9
3611	1987	01	27.36962	10	18	44.39	+12	12	46.2
3612	1987	01	04.13172	03	04	50.60	+16	37	34.8
3613	1987	01	28.20822	06	18	21.34	+30	39	11.4
3613	1987	02	26.17556	06	14	55.59	+30	43	32.9
3614	1986	11	01.28168	03	37	03.95	+38	22	23.7
3614	1986	12	05.24004	03	05	54.38	+35	26	57.9
3614	1986	12	29.08662	02	53	38.98	+32	26	44.3
3614	1987	01	29.04306	02	58	05.52	+29	30	15.9
3616	1986	11	30.34100	05	47	36.25	+11	45	35.2
3616	1986	12	28.32228	05	20	37.76	+12	48	33.9
3617	1987	01	30.03287	04	32	23.64	+03	22	34.2
3617	1987	02	27.02158	04	42	31.17	+06	17	43.7
3617	1987	02	28.02749	04	43	12.09	+06	24	15.2
3619	1986	10	07.32330	02	06	28.98	+07	01	23.4
3619	1986	10	30.17970	01	47	42.30	+04	23	21.2
3620	1986	10	30.11961	23	07	13.62	+08	05	11.9
3620	1986	10	31.06130	23	07	09.97	+08	00	45.9
3623	1986	12	28.11552	03	33	45.93	+15	47	10.0
3624	1986	12	28.36646	08	21	16.06	+26	44	03.1
3624	1987	01	27.22062	07	48	59.57	+28	01	06.0
3625	1986	12	05.25839	03	12	24.02	+15	59	06.6
3625	1987	01	04.10755	03	01	53.81	+14	52	23.6
3626	1986	12	05.21665	03	03	47.89	+21	41	38.5

3626		1986	12	28.07403	02	54	22.61	+20	23	30.8
3626		1987	01	29.09866	03	00	59.90	+19	56	45.9
3627		1987	01	04.35882	06	36	25.52	+27	22	30.3
3627		1987	01	28.18351	06	11	34.38	+28	54	57.8
3629		1986	12	05.40545	08	15	58.71	+13	13	51.1
3629		1987	01	27.18433	07	34	49.02	+12	47	16.9
3629		1987	02	28.09012	07	17	41.22	+14	08	11.0
A910	FA	1987	01	30.01310	04	28	05.58	+14	35	17.6
1931	TW	1987	02	28.33690	13	19	09.75	-09	21	19.9
1942	DB	1986	12	01.31617	04	40	00.25	+40	00	28.5
1942	DB	1986	12	28.28942	04	10	44.79	+37	49	41.1
1942	DB	1987	02	26.05374	04	18	57.40	+32	18	19.6
1952	QX	1987	02	26.10923	05	12	39.55	+23	10	01.5
1953	TH	1986	12	04.97204	00	02	33.28	+11	57	46.7
1953	TH	1986	12	28.95911	00	22	41.68	+13	24	55.1
1957	HK	1986	01	11.18413	04	40	40.20	+12	34	24.4
1957	HK	1987	03	27.35129	13	39	18.03	-13	05	38.9
1969	TR1	1986	12	01.00491	00	18	16.17	+04	13	53.4
1970	QA1	1986	10	05.97874	20	55	32.75	-14	52	00.2
1976	GM7	1987	02	27.29790	10	05	37.37	+05	46	28.1
1976	GM7	1987	04	02.07367	09	49	30.26	+09	24	17.1
1976	GO8	1987	02	25.33254	11	29	29.83	+04	35	19.0
1976	HQ	1987	02	25.42893	14	43	03.68	-06	34	49.1
1976	HQ	1987	03	27.36675	14	42	01.67	-05	02	12.4
1976	QX	1986	10	31.08231	23	37	29.12	-01	39	44.1
1976	SN3	1987	02	24.33425	11	50	50.43	+02	39	41.0
1976	SN3	1987	03	29.23804	11	31	12.91	+05	07	54.7
1976	SJ4	1986	11	30.40944	11	11	10.55	-00	46	43.8
1976	SJ4	1986	12	01.42935	11	12	26.18	-00	55	30.3
1976	YU5	1986	10	06.01956	21	36	10.28	-05	02	29.1
1977	DN4	1986	12	01.22524	02	55	26.23	+13	22	25.2
1977	DH11*	1977	02	22.29589	10	44	21.11	+13	23	18.0
1977	DJ11*	1977	02	22.29589	10	44	47.92	+13	12	59.3
1977	SN	1987	02	25.36196	11	37	40.89	+10	32	32.6
1977	SN	1987	03	29.19982	11	07	45.90	+13	46	33.2
1978	QX	1987	02	28.27808	10	32	56.06	+08	30	47.5
1978	QX	1987	03	30.13771	10	07	05.53	+10	48	44.2
1978	SA3	1986	10	31.12466	23	52	22.34	+02	13	54.8
1978	SA3	1986	11	28.07906	23	51	49.87	+02	12	06.1
1978	SA3	1986	12	01.95969	23	52	59.42	+02	19	07.6
1978	ST6	1987	02	27.16325	09	26	24.05	+05	24	39.7
1978	ST6	1987	03	30.11066	09	09	39.18	+07	57	53.7
1978	TQ7	1986	11	30.03542	23	57	11.89	-12	08	00.3
1978	UN2	1987	02	27.35426	10	29	27.83	+34	38	13.6
1978	UN2	1987	04	02.09663	10	02	53.97	+32	58	51.1
1978	UO2	1987	02	25.38085	12	06	12.81	+15	21	12.5
1978	UO2	1987	04	02.29374	11	38	31.84	+17	12	02.2
1978	UO2	1987	05	01.16862	11	22	32.27	+16	41	11.3
1978	VB5	1987	02	25.27293	10	51	10.84	+21	30	16.2
1978	VB5	1987	03	30.18442	10	23	19.71	+23	00	31.5
1979	EE	1987	01	27.25794	08	25	10.71	+29	42	48.5
1979	EE	1987	02	25.17803	08	00	03.26	+25	32	23.1
1979	SR9	1986	12	01.26873	03	36	10.15	+18	20	34.6
1979	SR9	1986	12	29.17286	03	15	54.81	+17	34	19.0
1979	SA10	1987	01	29.19774	05	50	41.63	+15	03	14.5
1979	SA10	1987	02	28.05173	05	53	32.75	+16	19	43.9
1979	SG10	1986	11	30.31094	04	45	12.74	+22	55	05.2
1979	SG10	1987	02	26.07406	04	26	57.77	+21	51	39.9

1979 UY3	1987 02	25.41254	14 22	14.74	-14 15	10.7
1979 UY3	1987 03	29.34396	14 15	44.45	-14 05	22.6
1979 VG	1986 11	28.10345	00 44	03.27	+06 45	35.4
1979 VG	1986 12	01.07500	00 44	29.81	+06 56	41.8
1980 DS	1987 02	27.19855	09 29	47.12	+15 12	00.2
1980 DL5	1986 10	08.37186	02 58	02.07	+17 05	19.3
1980 DL5	1986 10	29.24625	02 40	59.49	+16 22	18.8
1980 DL5	1986 10	30.22453	02 40	02.56	+16 19	26.8
1980 DL5	1986 11	30.17072	02 13	46.26	+14 51	11.9
1980 OF	1986 10	30.19480	01 53	28.34	+28 08	59.1
1980 OF	1986 12	01.13026	01 33	17.30	+25 09	23.0
1980 OF	1986 12	29.06146	01 35	22.57	+23 15	17.0
1980 RU2	1987 02	25.28841	11 12	48.57	+07 58	25.8
1980 TK5	1987 01	30.08150	06 02	13.04	+12 11	06.8
1980 TK5	1987 02	27.07319	06 00	44.60	+13 07	53.1
1981 EF	1987 03	29.30496	12 46	50.57	-10 52	48.0
1981 EJ17	1986 12	05.31341	04 30	32.66	+10 47	28.5
1981 EJ17	1986 12	29.19533	04 10	20.97	+09 57	52.6
1981 PM	1985 12	16.21469	03 04	27.51	+16 28	49.5
1981 PM	1987 02	26.28837	10 47	43.59	-01 27	43.5
1981 PM	1987 03	27.15047	10 21	22.04	+01 53	17.5
1981 QP	1987 02	27.38532	10 34	15.43	+24 06	50.1
1981 QP	1987 04	02.18548	10 07	44.37	+25 21	48.1
1981 QZ	1987 01	04.07934	02 48	06.03	+19 13	45.5
1981 QZ	1987 01	29.06313	03 01	05.33	+18 50	13.4
1981 QG1	1986 08	04.31154	22 12	41.40	+02 51	51.1
1981 QG1	1986 10	05.99661	21 37	23.97	-07 33	37.4
1981 SW6	1986 10	31.01350	21 34	10.89	-12 09	20.4
1981 TP1	1986 10	07.23737	01 01	03.84	+22 22	55.8
1981 TP1	1986 10	30.14154	00 44	48.34	+19 37	30.5
1981 TP1	1986 12	01.04830	00 35	25.93	+15 48	29.5
1981 TP1	1986 12	28.99740	00 44	38.87	+14 11	20.7
1981 TC3	1987 02	28.29506	10 34	53.60	+05 06	54.2
1981 UT15	1986 11	28.28813	04 53	54.36	+25 06	19.6
1981 VS	1987 02	24.06455	07 15	45.90	+09 00	21.0
1981 WG1	1987 01	30.06560	06 01	03.69	+14 58	14.0
1981 WG1	1987 02	25.08753	06 02	01.38	+17 16	34.9
1981 WG1	1987 04	02.04264	06 31	37.26	+19 35	04.8
1981 WO1	1986 11	28.40343	09 14	49.81	-07 20	22.1
1981 XH2	1986 12	01.03016	00 33	35.53	+10 20	04.8
1982 DR2	1987 02	27.11930	07 48	51.42	+07 41	07.6
1982 TX	1986 10	03.14320	21 43	00.11	+11 10	43.0
1982 TX	1986 10	30.00976	21 58	52.60	+03 43	46.8
1982 TX	1986 10	31.03922	22 00	06.89	+03 29	27.2
1982 TG1	1986 10	06.03830	22 03	59.52	+03 40	13.0
1982 UJ2	1985 09	17.18394	23 06	03.73	-10 26	06.9
1982 UJ2	1987 03	27.28267	11 42	55.14	+05 49	38.3
1982 UJ2	1987 03	29.28444	11 41	03.29	+05 54	30.2
1982 UM7	1987 02	26.33236	11 39	01.11	-00 36	17.8
1982 UO7	1987 02	24.38490	13 11	46.99	+01 04	16.1
1982 UO7	1987 03	27.29925	12 51	53.48	+04 09	11.4
1983 AV	1986 11	30.29348	04 34	18.46	+12 16	46.1
1983 AV	1986 12	28.13608	04 07	08.56	+13 50	25.5
1983 CN3	1987 03	30.20594	10 33	17.07	+18 14	25.6
1983 EV	1987 01	29.25564	06 55	00.60	+28 30	36.9
1983 EV	1987 01	30.17930	06 54	17.47	+28 30	10.4
1983 NK	1987 02	27.27441	10 43	55.97	-11 28	27.2
1984 EV	1986 12	01.34026	05 15	07.22	+34 22	14.5

1984 EV	1986 12	29.24042	04 42	27.33	+33 26	49.9
1984 FC	1986 12	28.27205	04 08	53.21	+28 27	53.5
1984 FC	1987 01	28.10861	04 03	58.69	+27 42	39.2
1984 GA	1987 02	26.30655	11 15	02.48	+06 36	03.4
1984 GA	1987 03	29.18465	10 44	25.00	+08 39	14.8
1984 SH5	1987 02	24.24164	10 31	50.32	+06 15	21.9
1984 SH5	1987 04	02.15480	10 11	52.41	+07 56	32.5
1984 YV	1986 11	29.99246	21 42	52.83	+10 52	03.6
1985 FC	1986 10	30.20974	02 01	55.45	+34 37	54.4
1985 FC	1986 12	01.15253	01 08	19.12	+36 00	31.8
1985 PL	1987 01	29.28740	08 24	08.89	+24 43	38.6
1985 PL	1987 02	25.20087	07 59	35.78	+24 03	00.6
1985 QQ	1987 02	26.38102	13 05	17.31	-04 38	49.4
1985 QQ	1987 03	29.32227	12 38	11.11	-03 08	04.7
1985 QS	1987 02	24.36340	12 49	55.52	-02 23	24.9
1985 QS	1987 03	29.26758	12 20	32.50	-00 40	10.9
1985 RL	1986 11	30.36014	06 20	05.49	+20 01	41.1
1985 RL	1987 01	04.28731	05 49	13.24	+20 17	23.0
1985 RK4	1987 01	28.28405	08 49	57.69	+18 36	16.6
1985 RK4	1987 02	26.19815	08 25	21.97	+20 00	18.3
1985 TQ	1986 10	29.38081	04 04	07.82	+22 47	57.9
1985 TQ	1986 10	31.35202	04 03	12.14	+22 46	30.6
1985 TQ	1986 11	28.23610	03 47	22.98	+22 11	59.7
1985 TT	1986 11	28.27074	04 54	29.72	+14 12	16.7
1985 TT	1986 12	28.18746	04 35	15.33	+13 36	29.2
1985 TF3	1987 01	27.11510	04 10	45.37	+28 04	22.0
1985 TF3	1987 01	28.12850	04 10	44.96	+28 02	54.0
1986 JA1	1986 10	07.98253	18 37	56.39	+05 06	51.5
1986 LA	1986 10	01.00532	20 18	35.14	+24 13	37.8
1986 LA	1986 10	29.06784	22 38	52.63	+10 24	45.7
1986 RA	1986 10	06.10556	23 21	18.18	-16 45	26.5
1986 RA	1986 10	29.11164	00 24	38.11	-23 42	37.8
1986 RA	1986 12	05.08820	01 28	54.78	-18 48	25.1
1986 RB	1986 10	30.99808	21 51	44.42	+11 31	52.7
1986 RB	1986 11	28.96140	22 20	26.10	+16 03	59.0
1986 RB	1986 12	27.94889	23 09	50.65	+21 09	55.5
1986 RB	1987 01	29.00614	00 19	40.43	+27 20	37.5
1986 RB	1987 02	02.03635	00 29	19.97	+28 07	04.3
1986 RC2	1986 10	30.07756	22 19	59.22	-10 00	15.4
1986 RC2	1986 12	27.98229	23 52	56.43	-13 24	58.6
1986 TM	1986 10	31.10290	23 40	04.63	+01 31	33.6
1986 TM	1986 11	28.97554	23 26	43.45	+07 35	33.9
1986 TM	1986 12	27.96247	23 42	31.87	+14 11	07.7
1986 TM	1987 01	29.01999	00 23	19.91	+22 12	21.6
1986 TM	1987 02	02.05194	00 29	49.43	+23 15	41.0
1986 TA2	1986 12	01.98592	00 50	17.66	-00 52	09.3
1986 TO4	1986 11	28.12298	00 46	05.88	+08 51	59.7
1986 TO4	1986 12	02.00947	00 46	10.59	+08 37	19.4
1986 TU5 *	1986 10	06.30208	01 50	32.84	+20 54	45.4
1986 TV5 *	1986 10	08.16101	23 36	13.73	-03 46	36.9
1986 UK3 *	1986 10	29.18633	01 39	50.20	+18 24	35.1
1986 UL3 *	1986 10	29.18633	01 40	14.36	+18 09	06.0
1986 UM3 *	1986 10	30.24705	02 57	07.15	+21 13	28.8
1986 VB1	1986 12	05.17118	02 25	10.77	+18 30	22.8
1986 VT6	1986 12	28.01011	01 44	00.90	+19 12	56.5
1986 WA	1986 12	02.12008	00 31	34.63	+10 05	19.7
1986 WA	1986 12	04.98974	00 42	13.75	+08 48	58.0
1986 XX	1986 11	30.31094	04 44	14.81	+22 49	19.3

1986	XO2		1987	03	27.11596	09	27	57.22	+19	26	19.2
1986	XA5	*	1986	12	01.34026	05	14	37.19	+34	23	11.2
1986	XR5	*	1986	12	05.29282	03	45	39.53	+23	51	03.0
1986	YE	*	1986	12	28.13608	04	07	08.94	+13	50	04.0
1987	BL	*	1987	01	29.25564	06	55	33.27	+28	24	16.8
1987	BL		1987	01	30.17930	06	54	28.93	+28	30	11.2
1987	DG1	*	1987	02	25.20087	07	59	20.08	+24	02	32.6
1987	DH1	*	1987	02	25.27293	10	51	41.41	+21	39	09.2
1987	DJ1	*	1987	02	25.36196	11	38	17.29	+10	25	01.6
1987	DK1	*	1987	02	28.29506	10	34	11.63	+05	06	09.1
1987	DZ4	*	1987	02	27.09188	07	41	59.37	+20	47	27.8
1987	EN		1987	05	02.07126	10	26	40.85	+19	47	36.5
1987	EA1		1987	04	26.19214	11	32	28.47	+09	16	56.4
1987	EA1		1987	05	02.09567	11	31	03.76	+09	18	05.2
1987	GA		1987	04	26.15211	11	11	08.32	+18	25	29.4
3524	P-L		1987	01	28.39771	10	31	47.51	+18	11	49.0
3524	P-L		1987	02	24.21979	10	04	01.56	+18	33	54.0

## Addendum

On February 24 the announcement of the appearance of supernova 1987A in the Large Magellanic Cloud caught astronomers by surprise. The availability for observation of the brightest supernova since 1604 has provided astrophysical research with an opportunity not likely to be repeated during the lifetime of anyone currently alive.

Since its establishment in 1919 the International Astronomical Union has had a mechanism for disseminating urgent information about unexpected astronomical phenomena. For the past 20 years or so the IAU Central Bureau for Astronomical Telegrams has functioned at the Smithsonian Astrophysical Observatory under the directorship of the co-investigator of this grant. The Central Bureau has attempted to keep pace with changes in communications technology over the years, with telex having gradually succeeded traditional telegrams and computer networks now succeeding traditional mail distribution. It has been and continues to be essentially the subscribers who pay for these services, however, and in the crisis associated with a spectacular discovery many scientists inevitably find that--for whatever reasons--they are not receiving the information they require as rapidly as they require.

Accordingly, in response to urgent requests from the community of astrophysicists who are particularly interested in supernovae, a special one-year supplement to this grant was initiated in April in the hope and expectation that the situation can be improved, particularly with regard to supernovae, and specifically with regard to the continuing dissemination of information about SN 1987A. The IAU Circulars, electronic versions of which have been available in the Central Bureau's Computer Service since 1984, have since February 24 been issued at an

unprecedentedly high rate. Direct electronic access to the Circulars has now become possible by SPAN for many VAX users in North America and western Europe. Indirect links, frequently involving TELENET, are being forged for non-VAX users and for users generally in Australia, South Africa and Japan. An alternate MicroVAX computer is in the process of being established in Cambridge with full network capability and in the hope that information can be accessed by and relayed to and from all potential users at all times.